EXHIBIT 2

Expert Report

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the movement and fate of drinking water constituents within water distribution systems and can be used for many different types of applications in water distribution systems analysis. It can also be used to model contamination threats and evaluate resilience to security threats or natural disasters relevant to water distribution systems. (https://www.epa.gov/water-research/epanet).

The applications listed above are all in the main core of tools used in the ATSDR studies of the Camp Lejeune site. They are all accepted methodologies and software that were used in similar studies at other sites by government agencies and consulting firms.

In addition to the above listed standard applications used in the water modeling field, ATSDR needed to investigate in more detail some of the questions that were raised by the expert panel convened by ATSDR/CDC. For that purpose, MESL research program capabilities were used to supplement the main core applications described above.

These supportive (sub-model) applications used in the ATSDR study of the Camp Lejeune site include:

- The **TechFlowMP** application is a multiphase flow and multispecies contaminant transport model developed in MESL studies (Jang, W. and Aral, MM, 2005; Jang, W. and Aral, MM, 2007; ATSDR 2007h; Jang, W. and Aral, MM, 2008: a, b; Jang, W. and Aral, MM, 2011). In **TechFlowMP** model the coupled equations for flow of water, gas, and NAPL phases and transport of multispecies contaminants in saturated and unsaturated subsurface systems and heat energy transport were formulated and analyzed. To solve those equations, a three-dimensional finite element numerical model (software) was developed. The origin of these studies at MESL research program dates to 1997. **TechFlowMP** model has been verified using analytical solutions and experimental data that are published and available in the literature. To investigate the fate and transport of VOCs in the subsurface, the model was used in conducting numerical analysis on the following other topics in other MESL studies: (i) multiphase flow and contaminant transport in subsurface environments; (ii) biological transformations of contaminants in multiphase environments; (iii) in-situ air sparging analysis (IAS); and, (iv) thermally enhanced venting (TEV) that is used in contaminated groundwater treatment processes. In these numerical studies, the **TechFlowMP** model successfully simulated the migration of contaminants between phases and between the unsaturated/saturated zones of a subsurface system, the dynamic movements of gas phases in the unsaturated zone, and remedial processes under in-situ air sparging (IAS) and thermally induced remediation (TEV) studies of the MESL program.

  This application was used to explore saturated and unsaturated zones and vapor phase contaminant distributions at the Camp Lejeune site. It also served the purpose of independent reconfirmation of the predictions of the calibrated multiphase subsurface models used by ATSDR at the Camp Lejeune site as described above (Figure 11). The ATSDR water modeling team first utilized the **MODFLOW** and **MT3DMS** codes in its groundwater simulations and analysis at the Camp Lejeune site. These two models are widely accepted public domain codes that have been tested and verified in other studies and are universally used in the modeling field for the analysis of groundwater flow and fate and transport of contaminants in subsurface systems (see above cited web sites). In addition to these studies, to enhance the understanding of conditions at the site, ATSDR extended its analysis. The ATSDR water modeling team applied the **TechFlowMP** software to understand and evaluate the unsaturated zone injection and migration conditions at

analysis procedure like, for example, Monte Carlo analysis that is routinely used in uncertainty analysis. Monte Carlo analysis, according to a well-established procedure, systematically evaluates the effects of uncertainty on the problem solution based on random synthetic data generation. In such an application, it is not certain that the random numbers generated would exactly represent the actual conditions for the problem at the site. However, the bounding limits of the analysis are the goal of the analysis. The application of **PSOpS**, in essence, is very similar to that analogy.

As I have stated earlier, this goes back to the NRC report statement about the "**accuracy**" of the uncertainty analysis results that cannot be justified scientifically. Also, I must emphasize again what I stated earlier: The domain of uncertainty analysis is a scientific field which is not in the realm of the traditional groundwater fate and transport analysis expertise and should be viewed using a different microscope and expertise.

Comment on p. 49 bullet seven: *The **TechFlowMP** model predicted very high vapor concentrations. For example, **TechFlowMP** predicted that the PCE vapor concentration in the top 10 ft of soil beneath the Tarawa Terrace elementary school should be 1,418 μg/L. Studies of PCE vapor concentrations in buildings that house or are near a drycleaning facility have reported measured concentrations around 55 μg/L.*

Response: This reference to a vapor concentration at 1,418 μg/L is another example of misrepresentation of the results of the modeling analyses conducted by the ATSDR water modeling team. This aforementioned information was taken from Chapter A of the ATSDR Tarawa Terrace report series (Maslia et al. 2007, p. A44). The statement provided in the ATSDR report reads as follows: ***"b. the maximum simulated PCE concentration in groundwater (model layer 1) at the Tarawa Terrace elementary school was 1,418 μg/L (Figure A15b), whereas the maximum simulated vapor-phase PCE (in the top 10 ft of soil) was 137 μg/L (Figure A20a)"***

The above sentence, taken directly from the ATSDR report submitted to NRC, clearly states that the groundwater (not vapor) concentration of PCE in layer "1" is at 1,418 μg/L concentration. Vapor concentration is given separately in the paragraph towards the end of that sentence. For the NRC report to represent this number (1,418 μg/L) as the vapor concentration that is simulated at the site to discredit a study is not appropriate for a scientific review. I will provide a more detailed analysis of this case using simulation results to bring clarity to the concern raised in the NRC report.

In this case, the work product referred to are the **TechFlowMP** modeling results and the analysis mentioned was conducted by the MESL - Georgia Tech research group participating in the ATSDR water modeling analysis of the ABC One-Hour Cleaners site and Tarawa Terrace and vicinity (Jang and Aral 2007). To provide the reader with clear evidence of scientific misrepresentation of the facts, the actual data reported in our report is presented below in sufficient detail, unlike the other responses I have provided to other comments in this document. In the numerical study of the multispecies, multiphase groundwater contamination at ABC One-Hour Dry Cleaners and Tarawa Terrace and vicinity, **TechFlowMP** simulations used two boundary-conditions to characterize the ground surface under the original pumping schedule: (1) GSBC = 0.01 and (2) GSBC = 1.0 (Jang and Aral 2007, p. G15). Here the acronym "GSBC" stands for the Ground Surface Boundary Condition. For the in-/out-flux of gas between the atmosphere and the unsaturated zone, if the ground surface does not have low-permeable zones or hindrances due to pavement, lakes, or buildings, the GSBC value is set to be 1.0. This implies that soil gas can be freely released into the atmosphere from the unsaturated zone. However, when some objects, including roads, buildings, ponds, or highly water-saturated areas, are present at the ground surface, the